

**REMARKS**

In the Office Action, dated November 1, 2002, the Examiner states that Claims 1-6 and 8-28 are pending, and Claims 1-6 and 8-28 are rejected. By the present Amendment, Applicant amends the claims.

In the Office Action, Claims 1-6, 10-11, 14 and 16-28 are rejected under 35 U.S.C. §102(e) as anticipated by US 6,399,257; Claims 1-21 are rejected under 35 U.S.C. §102(e) as anticipated by WO 99/08158; and Claims 1-6 and 8-28 are rejected under 35 U.S.C. §103(e) as unpatentable over WO 99/08158 in view of EP 0,665,449. The Applicant considers these rejections overcome by the present claim amendments for the following reasons.

Independent Claim 29 is based upon the previous Claim 2 with the added limitation that "a component which prevents intermixture of colors is not formed at a border part of the picture element". In the present invention according to Claim 29, a photocatalyst-containing layer is used, so that an extremely large wettability difference can exist between exposed and unexposed parts. Therefore, even if there is no component which prevents intermixture of colors formed at a border part of the picture element part, the picture element part can be formed without intermixture of the colors.

On the other hand, in EP 0,665,449, an intermixture preventing wall is formed on a resin composition formed on the base by a light irradiation treatment or light irradiation and heat treatments. The picture element part is formed by ejecting the inks in between the intermixture preventing walls using the ink-jet system. In EP' 449 intermixture of the picture element parts is prevented by using this intermixture preventing wall, and is not prevented by the wettability difference. That is, the wettability difference is not used in EP' 449, but instead uses the absorptivity difference to form an intermixture preventing wall through which ink can not be absorbed into the resin composition, and picture element part, which absorbs the ink. With this, for the first time, intermixture of colors, when the picture element part is formed, is prevented. Therefore, the intermixture preventing wall is a fundamental composition to the invention disclosed in EP' 449. Consequently, a characteristic

configuration of the present invention which "a component which prevents intermixture of colors is not formed at a border part of the picture element part" is not disclosed nor suggested at all in EP' 449.

In addition, a light shielding layer is formed in between the picture element parts in WO 99/08158 (WO' 158). The present invention relates to a color filter without a shading part (black matrix). The present invention according to Claim 1, a difficult problem, of forming a picture element part by an ink-jet system with high precision, is solved in a state which convex parts, such as shading parts, are not formed. According to Claim 29 to solve this problem, a photocatalyst-containing layer is used, and by using the wettability differences due to irradiation with energy, an effect, that a picture element part can be formed with high precision by an ink-jet system without a shading part, is achieved. On the other hand, all color filters in cited reference WO' 158 have a light shielding layer, and there is no description nor suggestion about color filters without a shading part. Furthermore, because the light shielding layer described in WO' 158 is a component formed at a border part of the picture element part to prevent intermixture of colors, a characteristic configuration of the present invention according to Claim 29 which "a component which prevents intermixture of colors is not formed at a border part of the picture element part" is not disclosed in the cited reference.

As mentioned in the above, a composition which prevents intermixture of colors is not formed at a boundary portion of the picture element part, and the peculiar effect is achieved in a color filter without a shading part, that for the first time by using a photocatalyst-containing layer, a high quality color filter which intermixture of colors is prevented. Therefore, the present invention according to Claim 29 is not obvious from the combination of WO' 158 and EP' 449.

Independent Claim 31 is based upon previous Claim 4 and further includes that an ink-repellent convex part is formed on the photocatalyst-containing layer at a border part of the picture element part, and intermixture of colors when forming a picture element part is thereby prevented.

The above mentioned configuration is not disclosed in WO' 159 nor EP' 449. Therefore, Claim 31 is not obvious from the combination of WO' 158 and EP' 449.

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Independent Claim 32 is based upon previous Claim 5 and further includes that a photocatalyst-containing layer which the wettability is changeable by irradiation is formed at a border part of the picture element part, and intermixture of colors when forming a picture element part is thereby prevented.

The above mentioned configuration is not disclosed in WO' 158 nor EP' 449. Therefore, Claim 32 is not obvious from the combination of WO' 158 and EP' 449.

Independent Claim 44 is based upon previous Claim 18 and further includes that a component is not formed which prevents intermixture of colors at a border part of the picture element part. Thus Claim 44 is about a process for producing a color filter described in Claim 29, so that it is not obvious from the combination of WO' 158 and EP' 449, for the same reason as Claim 29.


Independent Claims 46 and 48 relate to a process for producing a color filter as mentioned in Claims 31 and 32, and are not obvious from the combination of WO' 158 and EP' 449, for the same reasons those claims are not obvious.

Independent Claim 54 relates to a liquid crystal panel using the color filter described in Claim 29, and is not obvious over the combination of WO' 158 and EP' 449, for the same reasons that claim is not obvious.

In light of the foregoing response, all the outstanding objections and rejections have been overcome. Applicant respectfully submits that this application should now be in better condition for allowance and respectfully requests favorable consideration.

Respectfully submitted,

April 29, 2003  
Date

  
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DOCKET: CU-2263

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Masato Okabe et al. ) Group Art Unit: 1756  
SERIAL NO: 09/607,010 ) Examiner: John A. McPherson  
FILED: June 29, 2000 ) **EXPEDITED PROCEDURE**  
TITLE: Color Filter and Process for Producing the Same ) **AMENDMENT AFTER FINAL**

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THE ASSISTANT COMMISSIONER FOR PATENTS  
Washington, D.C. 20231

## AMENDED CLAIMS

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29. (new) A color filter, in which a shading part provided on a border part of a picture element part is not formed, comprising a transparent substrate, a photocatalyst-containing layer formed on the transparent substrate comprising at least a photocatalyst and a binder, and having a wettability which is changed so that a contact angle with a liquid is reduced by an energy irradiation, and the picture element part being provided on the photocatalyst-containing layer by a pattern of a plurality of colors with an ink jet system, and wherein a component which prevents intermixture of colors is not formed at the border part of the picture element part.

30. (new) The color filter according to Claim 29, wherein a space between the picture element parts is not more than 2  $\mu\text{m}$ .

31. (new) A color filter, in which a shading part provided on a border part of a picture element part is not formed, comprising a transparent substrate, a photocatalyst-containing layer formed on the transparent substrate comprising at least a photocatalyst and a binder, and having a wettability which is changed so that a contact angle with a liquid is reduced by an energy irradiation, and the picture element part being provided on the photocatalyst-containing layer by a pattern of a plurality of colors with an ink jet system; and wherein an ink-repellent convex part is formed on the photocatalyst-containing layer at the border part of the picture element part.

32. (new) A color filter, in which a shading part provided on a border part of a picture element part is not formed, comprising a transparent substrate, a picture element part provided on the transparent substrate by a pattern of a plurality of colors with an ink jet system, and a photocatalyst-containing layer formed on the border part of the picture element part comprising at least a photocatalyst and a binder, and having a wettability which is changed so that a contact angle with a liquid is reduced by an energy irradiation.

33. (new) The color filter according to Claim 32, wherein the wettability on the transparent substrate is less than 10 degrees in terms of the contact angle with a liquid having the surface tension of 40 mN/m.

34. (new) The color filter according to Claim 29, wherein the photocatalyst-containing layer contains fluorine and the photocatalyst-containing layer is formed so that the fluorine content in a surface of the photocatalyst-containing layer is reduced by an action of the photocatalyst upon irradiating the photocatalyst-containing layer with energy as compared with before the energy irradiation.

35. (new) The color filter according to Claim 34, wherein the fluorine content in a part in which the fluorine content is reduced by irradiating the photocatalyst-containing layer with energy is 10% or less relative to the fluorine content of a part not irradiated with energy.

36. (new) The color filter according to Claim 29, wherein the photocatalyst is one or more substances selected from the group consisting of titanium oxide ( $\text{TiO}_2$ ), zinc oxide ( $\text{ZnO}$ ), tin oxide ( $\text{SnO}_2$ ), strontium titanate ( $\text{SrTiO}_3$ ), tungsten oxide ( $\text{WO}_3$ ), bismuth oxide ( $\text{Bi}_2\text{O}_3$ ) and iron oxide ( $\text{Fe}_2\text{O}_3$ ).

37. (new) The color filter according to Claim 36, wherein the photocatalyst is titanium oxide ( $\text{TiO}_2$ ).

38. (new) The color filter according to Claim 37, wherein the photocatalyst-containing layer contains a fluorine element in a surface of the photocatalyst-containing layer at rate of 5 times more relative to the Ti element as determined by a X-ray photoelectron spectroscopy.

39. (new) The color filter according to Claim 29, wherein the binder is organopolysiloxane having a fluoroalkyl group.

40. (new) The color filter according to Claim 29, wherein the binder is organopolysiloxane which is a hydrolyzed and condensed compound or co-hydrolyzed and condensed compound of one or more of silicon compounds represented by  $\text{YnSiX (4-n)}$  wherein Y represents alkyl group, fluoroalkyl group, vinyl group, amino group, phenyl group or epoxy group, X represents alkoxy group or halogen, and n is an integer of 0 to 3.

41. (new) The color filter according to Claim 40, wherein a silicon compound having a fluoroalkyl group among the silicon compounds constituting the organopolysiloxane is contained at an amount of 0.01 mol% or more.

42. (new) The color filter according to Claim 29, wherein a contact angle with a liquid having the surface tension of 40 mN/m on the photocatalyst-containing layer is not less than 10 degrees at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

43. (new) The color filter according to Claim 29, wherein the picture element part colored with an ink jet system is a picture element part colored with an ink jet system using a UV-curing ink.

44. (new) A process for producing a color filter, in which neither a shading part nor a component which prevents intermixture of colors, provided on a border part of a picture element part, is formed, which comprises:

(1) a step of providing a photocatalyst-containing layer having a wettability of the energy-irradiated part which changes in a direction of reduction of the contact angle with a liquid, on a transparent substrate;

(2) a step of forming an exposed part for a picture element part by pattern-irradiating with energy on a picture element part forming portion on which the picture element part, on the photocatalyst-containing layer formed on the transparent substrate, is to be formed; and

(3) a step of coloring the exposed part for the picture element part with an ink jet system, to form the picture element part.

45. (new) The process for producing a color filter according to Claim 44, wherein the step of forming the exposed part for the picture element part, then coloring the exposed part with the ink jet system to form the picture element part, comprises steps:

(a) a step of forming a first exposed part for a first picture element part by pattern-irradiating with energy on a part of the picture element part forming portion on which the picture element part, on the photocatalyst-containing layer, is to be formed;

(b) a step of forming the first picture element part by coloring the first exposed part for the first picture element part with the ink jet system;

(c) a step of forming a second exposed part for a second picture element part by irradiating with energy on a remaining part of the picture element part forming portion on which the picture element part, on the photocatalyst-containing layer, is to be formed; and

(d) a step of forming the second picture element part by coloring the second exposed part for the second picture element part with the ink jet system.

46. (new) A process for producing a color filter, in which a shading part provided on a border part of a picture element part is not formed, which comprises:

(1) a step of providing a photocatalyst-containing layer having the wettability of the energy-irradiated part which changes in a direction of reduction of the contact angle with a liquid, on a transparent substrate;

(2) a step of forming an exposed part for an ink-repellent convex part by pattern-irradiating with energy on an ink-repellent convex part forming portion on which the ink-repellent convex part, on the photocatalyst-containing layer formed on the transparent substrate, is to be formed;

(3) a step of forming the ink-repellent convex part by applying an ink to the exposed part for an ink-repellent convex part;

(4) a step of forming an exposed part for a picture element part by irradiating with energy on a picture element part forming portion on which the picture element part, on the photocatalyst-containing layer formed on the transparent substrate, is to be formed; and

(5) a step of coloring the exposed part for the picture element part with an ink jet system, to form the picture element part.

47. (new) The process for producing a color filter according to Claim 46, wherein the ink-repellent convex part is formed between the picture element parts.

48. (new) A process for producing a color filter, in which a shading part provided on a border part of a picture element part is not formed, which comprises:

(1) a step of providing a photocatalyst-containing layer having a wettability of an energy-irradiated part which changes in a direction of reduction of a contact angle with a liquid, at the border part of a picture element part forming portion on which the picture element part is to be formed, on a transparent substrate; and

(2) a step of forming the picture element part on the picture element part forming portion on the transparent substrate.

49. (new) The process for producing a color filter according to claim 22, wherein the wettability on the transparent substrate is less than 10 degrees as the contact angle with a liquid having the surface tension of 40 mN/m.

50. (new) The process for producing a color filter according to Claim 44, wherein the contact angle on the photocatalyst-containing layer with a liquid having a

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surface tension of 40 mN/m is 10 degrees or more at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

51. (new) The process for producing a color filter according to Claim 48, wherein the contact angle on the photocatalyst-containing layer with a liquid having a surface tension of 40 mN/m is 10 degrees or more at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

52. (new) The process for producing a color filter according to Claim 44, wherein the step of coloring the exposed part for the picture element part with the ink jet system uses a UV-curing ink.

53. (new) The process for producing a color filter according to Claim 48, wherein the step of coloring the exposed part for the picture element part with the ink jet system uses a UV-curing ink.

54. (new) A liquid crystal panel comprising a color filter according to Claim 29 and a substrate which are opposite to the color filter, and provided a shading part, wherein a liquid crystal compound is encapsulated between both substrates.

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